

BC HYDRO & FORTIS BC

RESOURCE OPTIONS UPDATE  
ENGAGEMENT FOLLOW UP – SOLAR

EDMUND LAI



FOR GENERATIONS

June 29, 2015

## Purpose of Session:

- Review results of the solar characterization update

## Scope

- Focus on utility scaled PV

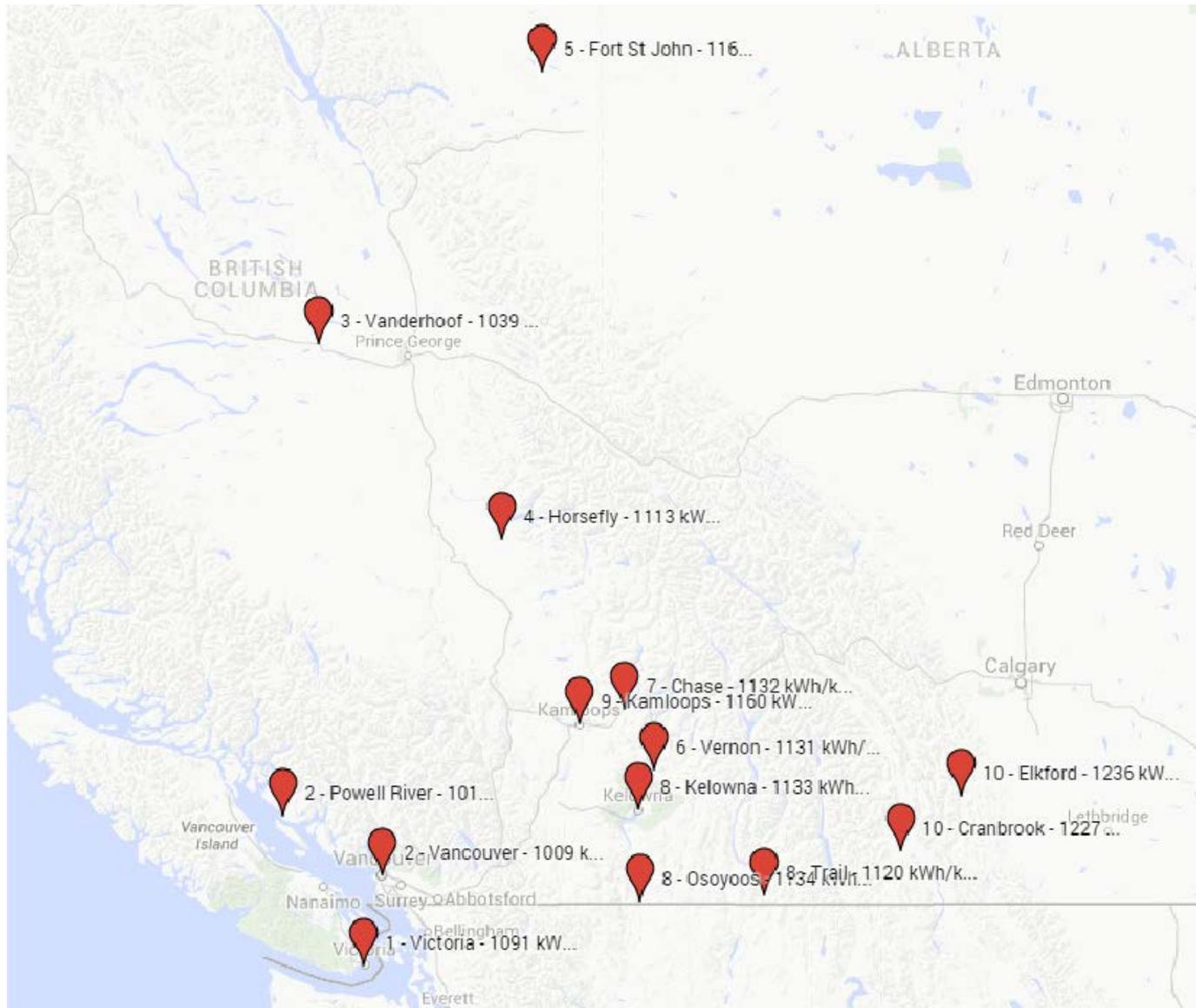
## Methodology

- Used 10 locations identified in the 2010 ROR and added 3 incremental sites near or within the Fortis service territory
- Estimated the potential power output and cost of a hypothetical 5 MW solar PV project at each location
- Estimated the unit energy cost (UEC) for each PV location

## Assumptions

- Project life of 25 years, with a 4 year lead time
- PV will be single axis tracking with no tilt
- Capacity factors ranges from 14% to 17% the 13 locations
- Calculation of UEC includes \$1.88/W US dollars (from consultants), 5% soft cost\*, transmission line and road construction costs (from KWL) and OMA costs (from EIA)

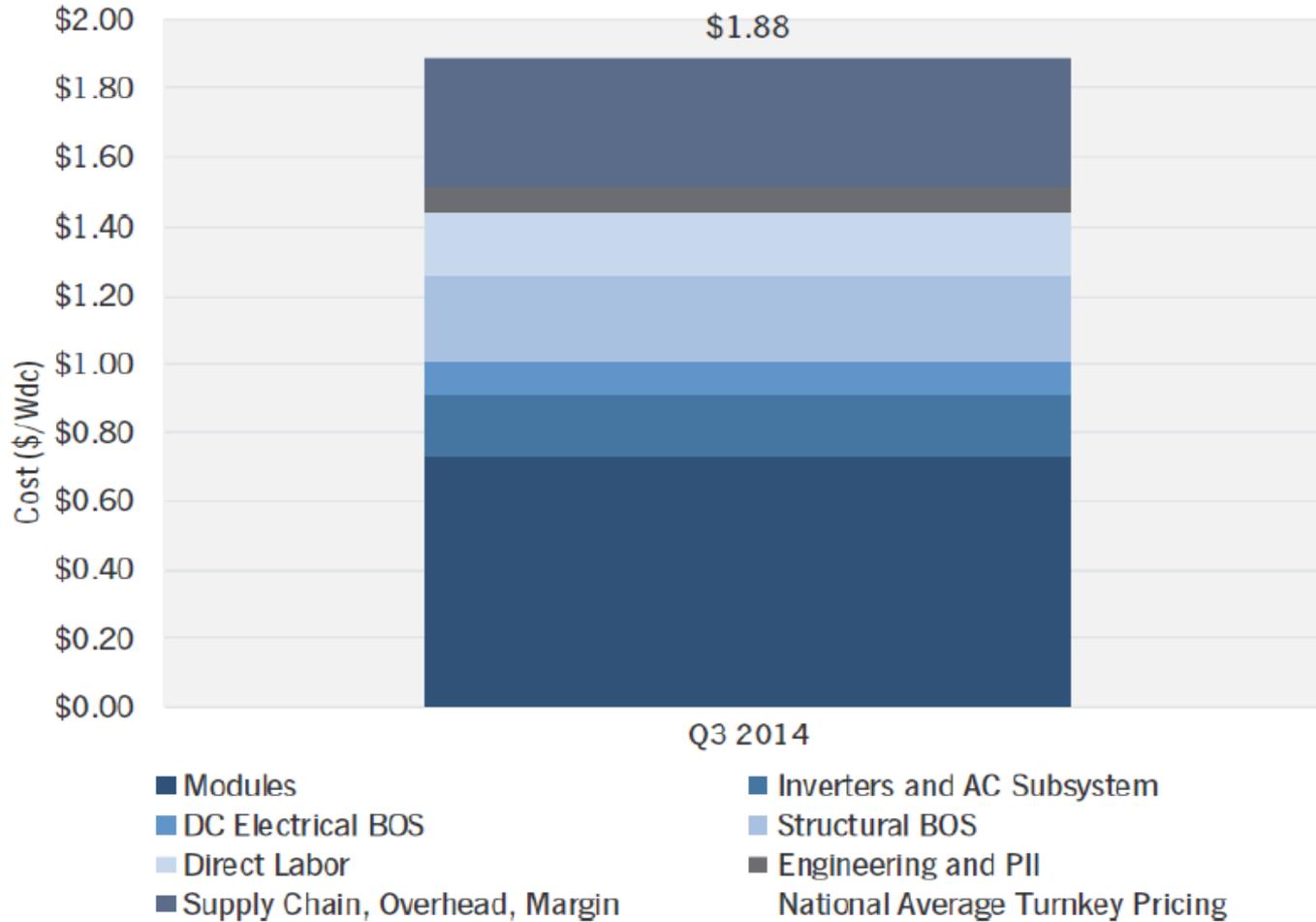
\*Soft cost includes regulatory, permitting, consultation-related costs



*Table 1 - Sites for Solar Potential Analysis and BC Transmission Region*

<b>Transmission Region Number</b>	<b>Transmission Region Name</b>	<b>Analysis Site</b>	<b>Solar Potential (kWh/kW/a)</b>
1	Vancouver Island	Victoria	1091
2	Lower Mainland	Vancouver	1009
2	Lower Mainland	Powell River	1019
3	North Coast	Vanderhoof	1039
4	Central Interior	Horsefly	1113
5	Peace Region	Fort St. John	1162
6	Revelstoke	Vernon	1131
7	Mica	Chase	1132
8	Selkirk	Osoyoos	1134
8	Selkirk	Kelowna	1133
8	Selkirk	Trail	1120
9	Kelly/Nicola	Kamloops	1160
10	East Kootenay	Elkford	1236
10	East Kootenay	Cranbrook	1227

*Figure 19 - Modeled Utility Turnkey Single-Axis Tracking PV System Pricing With Cost Breakdown (GTM Research, USD)*



*Table 4 - Cost Components of Modeled Utility Turnkey Single-Axis Tracking PV System Pricing (GTM Research)*

<i>Component</i>	<i>Cost (2014 USD)</i>	<i>Percent of System Cost</i>
Modules	\$0.73	38.8%
Inverters and AC Subsystem	\$0.18	9.6%
DC Electrical Balance of System	\$0.08	4.3%
Structural Balance of System	\$0.25	13.3%
Direct Labor	\$0.18	9.6%
Engineering and Permitting, Inspection and Interconnection	\$0.07	3.7%
Supply Chain, Overhead, Margin	\$0.39	20.7%

**Table 1. Estimated levelized cost of electricity (LCOE) for new generation resources, 2020**

U.S. average levelized costs (2013 \$/MWh) for plants entering service in 2020<sup>1</sup>

Plant type	Capacity factor (%)	Levelized capital cost	Fixed O&M	Variable O&M (including fuel)	Transmission investment	Total system LCOE	Subsidy <sup>2</sup>	Total LCOE including Subsidy
<b>Dispatchable Technologies</b>								
Conventional Coal	85	60.4	4.2	29.4	1.2	95.1		
Advanced Coal	85	76.9	6.9	30.7	1.2	115.7		
Advanced Coal with CCS	85	97.3	9.8	36.1	1.2	144.4		
<b>Natural Gas-fired</b>								
Conventional Combined Cycle	87	14.4	1.7	57.8	1.2	75.2		
Advanced Combined Cycle	87	15.9	2.0	53.6	1.2	72.6		
Advanced CC with CCS	87	30.1	4.2	64.7	1.2	100.2		
Conventional Combustion Turbine	30	40.7	2.8	94.6	3.5	141.5		
Advanced Combustion Turbine	30	27.8	2.7	79.6	3.5	113.5		
Advanced Nuclear	90	70.1	11.8	12.2	1.1	95.2		
Geothermal	92	34.1	12.3	0.0	1.4	47.8	-3.4	44.4
Biomass	83	47.1	14.5	37.6	1.2	100.5		
<b>Non-Dispatchable Technologies</b>								
Wind	36	57.7	12.8	0.0	3.1	73.6		
Wind – Offshore	38	168.6	22.5	0.0	5.8	196.9		
Solar PV <sup>3</sup>	25	109.8	11.4	0.0	4.1	125.3	-11.0	114.3
Solar Thermal	20	191.6	42.1	0.0	6.0	239.7	-19.2	220.6
Hydroelectric <sup>4</sup>	54	70.7	3.9	7.0	2.0	83.5		

Location	# of Project	Installed Capacity (MW)	Annual Energy (GWh/yr)	UEC at Gate Range (\$2015/MWh)	UEC at POI Range (\$2015/MWh)
Vanderhoof	1	5	5	206	206
Fort St. John	1	5	6	186	200
Powell River	1	5	5	210	215
Victoria	1	5	6	196	255
Kamloops	1	5	6	185	205
Osoyoos	1	5	6	189	678
Elkford	1	5	6	175	186
Chase	1	5	6	190	221
Vernon	1	5	6	190	222
Horsefly	1	5	6	194	248
Kelowna	1	5	6	190	205
Trail	1	5	6	192	211
Cranbrook	1	5	6	175	193
Total	13	65	80	175-210	186-678

Post-meeting note:  
 This table has been updated based on feedback from the meeting and can be found in the summary notes

# THANK YOU / HOW TO CONNECT

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## General information and engagement materials

- [www.bchydro.com/generationoptions](http://www.bchydro.com/generationoptions)